CLAIMS

1. A load sensor assembly, comprising:

a substantially square plate;

a hole in each of four corners of said plate for receiving a fastener therethrough;

a first axis defined by a first pair of diagonally opposed ones of said holes;

a second axis defined by a second pair of diagonally opposed ones of said holes;

a strain gauge secured to said plate.

2. The load sensor of claim 1 wherein said strain gauge comprises at least two uniaxial strain elements, each of said two uniaxial strain elements having an axis of sensitivity, and wherein said two uniaxial strain elements are oriented within said strain gauge such that their respective axes of sensitivity are perpendicular to one another.

3. The load sensor of claim 2 wherein said strain gauge is secured to said plate such that one of said axes of sensitivity is parallel to said first axis and the other of said axes of sensitivity is parallel to said second axis.

4. The load sensor of claim 3 wherein said strain gauge is mounted on said plate so as to be substantially centered thereon.

5. The load sensor of claim 4 wherein said strain gauge comprises four uniaxial strain elements in a square pattern on said strain gauge, a first pair of diagonally opposed ones of said elements having axes of sensitivity oriented parallel to said first axis and a second pair of diagonally opposed ones of said elements having axes of sensitivity oriented parallel to said second axis.

6. The assembly of claim 5 further comprising:

a plurality of standoffs mounted on said plate, said standoffs not lying on either said first or second axes;

a printed circuit board mounted on said standoffs and overlaying said strain gauge;

said printed circuit board containing traces defining a Wheatstone full bridge configuration including said four elements of said strain gauge, and lead-throughs for establishing electrical connection between said traces and a plurality of leads emanating from said strain gauge;

said leads extending from said strain gauge through said lead-throughs;

said plate having substantially straight sides; and,

a cover mounted on said plate to cover said standoffs, printed circuit board and strain gauge, said cover being criented such that its corners lie along lines bisecting the straight sides of said plate.

7. The assembly of claim 3 further comprising a cover having a square cross section is mounted to said plate to overlie said strain gauge, and wherein said cover is mounted such that each of its sides is perpendicular to either said first or second axis.

8. The assembly of claim 6 wherein said cover has a square cross section and is mounted such that each of its sides is perpendicular to either said first or second axis.

9. A method of detecting strain in a structure comprising mounting the assembly of claim 1, 5 or 6 on said structure by inserting fastening elements through said holes such that said first axis lies along a principal strain axis along which strain is to be measured.

10. A method of sensing the load in a container, said container having a structural element that is subject to a strain along a principal strain axis when the container is loaded comprising mounting the assembly of claim 1, 5 or 6 on said structural element by inserting fastening elements through said holes such that said first axis lies along the principal strain axis.

11. A load sensor assembly, comprising:

a square plate;

a hole in each of four corners of said plate for receiving a fastener therethrough;

a first uniaxial strain gauge secured to said plate along a first axis defined between a first pair of diagonally opposing ones of said holes;

a second uniaxial strain gauge secured to said plate along a second axis defined by a second pair of diagonally opposed ones of said holes.

12. The assembly of claim 11 further comprising:

a plurality of standoffs mounted on said plate, said standoffs not lying on either said first or second axes;

a printed circuit board mounted on said standoffs and directly overlaying said first and second strain gauges;

said printed circuit board containing traces defining a Wheatstone full bridge configuration including said first and second strain gauges, and lead-throughs for establishing electrical connection between said traces and a plurality of leads emanating from said first and second strain gauges;

said leads extending from said first and second strain gauges through said lead-throughs; and,

a cover mounted mounted on said plate to cover said standoffs, printed circuit board and strain gauges, said cover being oriented such that its corners lie along lines bisecting the straight sides of said plate.

13. The assembly of claim 11 further comprising a cover having a square cross section is mounted to said plate to overlie said strain gauge, and wherein said cover is mounted such that each of its sides is perpendicular to either said first or second axis.

14. The assembly of claim 12 wherein said cover has a square cross section and is mounted such that each of its sides is perpendicular to either said first or second axis.

15. A method of detecting strain in a structure comprising mounting the assembly of claim 11, 12 or 14 on said structure by inserting fastening elements through said holes such that said first axis lies along a principal strain axis along which strain is to be measured.

16. A method of sensing the load in a container, said container having a structural element that is subject to a strain along a principal strain axis when the container is loaded comprising mounting the assembly of claim 11, 12 or 14 on said structural element by inserting fastening elements through said holes such that said first axis lies along the principal strain axis.

17. The assembly as in claims 6 or 12 further comprising a digital potentiometer in parallel with said bridge configuration, at least one zero load calibration button and at least one full load calibration button, and control means responsive to said zero load calibration button to cause said potentiometer to adjust so as to balance said bridge.

18. A load sensing system for providing information regarding the load status of a remote container comprising:

a load sensor assembly comprising a square plate having a hole in each of four corners of said plate for receiving a fastener therethrough, said plate having a first axis defined by a first pair of diagonally opposed ones of said holes and a second axis defined by a second pair of diagonally opposed ones of said holes;

a strain gauge secured to said plate;

processing means associated with said container for determining said load status based on an output of said strain gauge;

communication means for transmitting load status information to a remote server;

database means associated with said remote server for correlating said load status to one of a plurality of remote individual containers; and

a web server for displaying said load status information.

19. The apparatus of claim 18 wherein said load sensor assembly further comprises:

a plurality of standoffs mounted on said plate, said standoffs not lying on either said first or second axes;

a printed circuit board mounted on said standoffs and directly overlaying said strain gauge;

said printed circuit board containing traces defining a Wheatstone full bridge configuration including said strain gauge, and lead-throughs for establishing electrical connection between said traces and a plurality of leads emanating from said strain gauge;

said leads extending from said strain gauge through said lead-throughs; and,

a cover mounted on said plate to cover said standoffs, printed circuit board and strain gauge, said cover being oriented such that its corners lie along lines bisecting the straight sides of said plate.

20. A load sensing apparatus comprising:

at least two strain sensing elements;

a Wheatstone bridge circuit comprising said at least two strain sensing elements;

a digital potentiometer connected to said bridge circuit; and,

processing means for causing said digital potentiometer to adjust so as to balance said Wheatstone bridge.

21. The load sensing apparatus of claim 20 wherein said Wheatstone bridge circuit comprises at least four strain sensing elements rigidly associated with a mounting plate, and wherein a first pair of said elements are oriented on said mounting plate along a principal strain

axis thereof, and a second pair of said elements are oriented on said mounting plate perpendicular to said principal strain axis.

22. The load sensing apparatus of claim 21 where said plate is square and said principal strain axis is defined as an axis extending between two opposed corners of said plate.